

Information Handling is the Problem

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Panel - Help and Hindrance: Impact of Automation on
Experts Collaborating in High Stakes Settings

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Automation Story

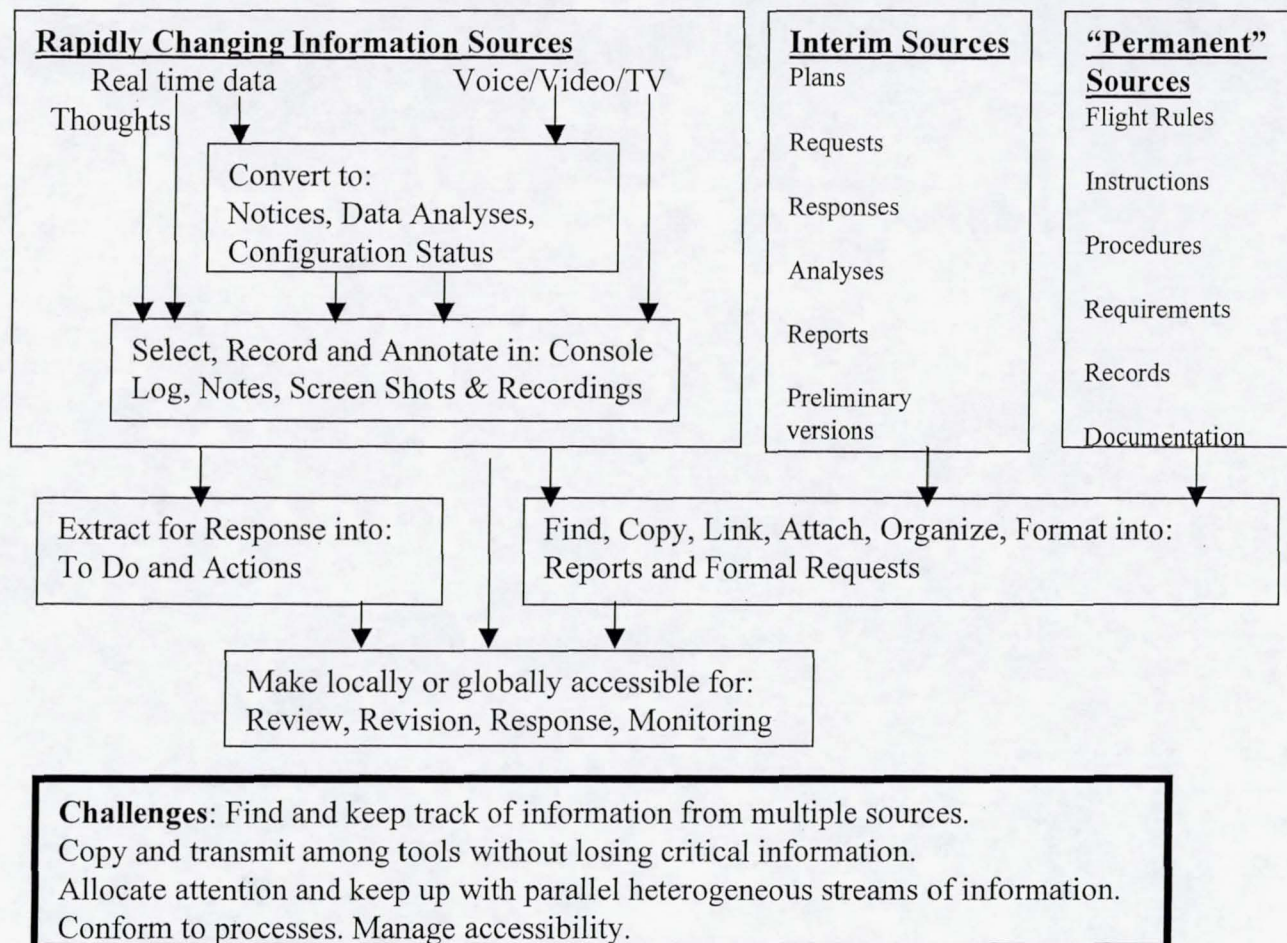
- Two types of “decision support” software supporting most Space Station Flight Controllers
 - Elog: Simple messages triggered by real-time telemetry values
 - CRANS: Expert system logic to interpret data patterns
- Elog is too simple – resulting in “Spam”.
- CRANS is too complex – only the flight controller who created the logic is comfortable using it.
- Dilemma: Too simple or too complex. Where’s the middle ground?

Human-Centered Question:

So what's the problem at work?

- Human Centered Autonomous and Assistant Systems Testbed (HCAAST) Project
- Study flight controllers at work, in the bigger picture
 - How are the tasks related?
 - What are the communication patterns?
 - How is the set of related tasks supported?
 - What are the problems?
- Studies of flight controllers in mission control
 - Information handling is a dominant problem
 - Multiple teams coordinating is a dominant problem

Information Handling on Control Center Shifts



Focus is on Intelligent Assistants for Information Handling

- Team Work Center concept
 - Information infrastructure compatible with automation
 - Electronic Console Log enables conversion of diary notes into database entries
- Intelligent Briefing and Response Assistants use the same tools as the flight controllers
 - Instruct them to automate what they do with the information

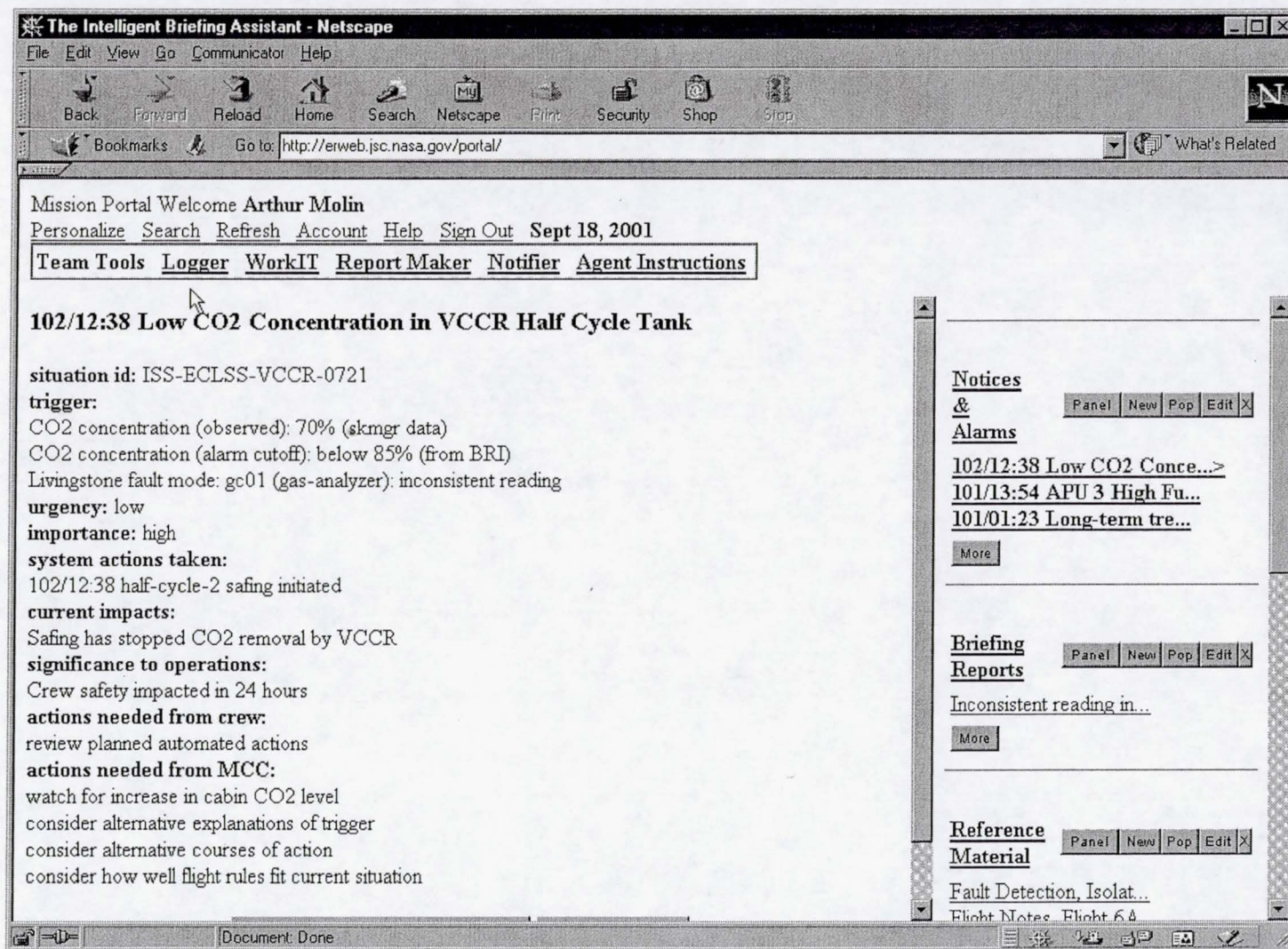
Team Work Center

- Electronic console logger
 - Create a database of log entries
 - Filter, search, view large log files
 - Generate reports and specialized logs
- Workspace manager
 - Collect & share items related to a work topic in one accessible workspace
 - Handle files, links, actions, logs, and paperwork
- Report maker
 - Create report formats (notices, shift reports, reports about anomalies)
 - Collect information from multiple sources into formatted reports
- Notifier
 - Manage notification of team members on or off console
- Instructions and procedures
 - Specify automation and team processes and procedures

Assistant Agent Tasks

- Convert data and information to **notices** and **data analyses**, collect and organize data associated with an event.
- Automate and assist getting data and information into shift **logs and notes**, producing filtered notes, updating and searching for selected entries.
- Automate and assist pulling together and linking data, information, log entries and notes into **reports**.
- Automate and assist distributed review and revision and update processes for **reports** and **official paperwork requests**.
- Automate and assist selecting, collecting/linking, organizing, archiving and accessing distributed stable data in shareable issue-focused **workspaces**.

Concept for Team Work Center



Help and Hindrance: Impact of Automation on Experts Collaborating in High Stakes Settings

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Moderator: Paul Gorman, MD

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Public attention to the problems of quality and safety in healthcare has grown rapidly since the publication of the Institute of Medicine report *To Err is Human*. While debate exists about the appropriate regulatory, professional, and organizational responses to the problem, all agree that improving healthcare quality and reducing medical errors deserve the highest priority.

An important part of the response to these concerns are the roles that information and communication technologies (ICT) can play. Whether to capture clinical data, standardize data definitions and reporting procedures, develop data mining and analytic methods to better understand healthcare processes, or provide point of care assistance to clinicians, computerized information systems are increasingly expected to play major roles in improving quality and reducing errors. Indeed, evidence already exists, albeit from only a few institutions, that such systems can reduce potential adverse events, improve adherence to clinical guidelines, and reduce inappropriate testing.

Caution is appropriate, however, before widespread deployment of systems meant to improve the quality of healthcare. Lessons from

aviation, aerospace, and military applications, suggest that information systems may sometimes worsen the situation and interfere with human performance. Problems include phenomena such as "automation surprise," "automation complacency," and "mode confusion," to name a few. Ongoing research at NASA and other institutions stresses how information systems must function as effective team players if they are to be helpful to experts collaborating in complex, high stakes situations.

This panel is comprised of experts in engineering, cognitive science, and social and organizational informatics. Their expertise includes studies of the use and impact of information systems in aerospace, military, nuclear power, and healthcare applications and in existing social organizations. Each panelist will present case studies and lessons learned from introduction of information systems into real world environments. Open discussion with those attending the panel will explore application of these principles to healthcare applications.

Jane Malin is with the Intelligent Systems Branch, in the Automation, Robotics and Simulation Division in the Engineering Directorate at NASA Johnson Space Center. Her

work in artificial intelligence research and development has been in three areas: intelligent modeling and simulation, intelligent systems for control centers, and human interaction design for intelligent systems.

Laura Militello is Senior Research Associate at Klein Associates, Inc., a cognitive science group focused on improving interactions between technology and people, among team members, and between decision makers and their environments. Their research and consulting has included settings such as the nuclear power industry, military decision makers, and health care, with a goal of enhancing the performance of those confronted with judgments and decisions in situations marked by high stakes, time pressure, ambiguous or conflicting information, and rapidly changing situations.

Emily Patterson received her Ph.D. in Industrial and Systems Engineering from The Ohio State University last December, advised by Professor David Woods. In her graduate research, supported by a National Science Foundation Graduate Fellowship, NASA Johnson, and Rome and Armstrong Laboratories, she developed innovative visualizations to deal with data

overload in intelligence analysis. She is currently a Research Specialist at the Ohio State University and the Veteran's Administration Midwest Patient Safety Center of Inquiry, conducting research on how the introduction of new technologies such as bar coding affect patient safety.

Steve Sawyer conducts research on social and organizational informatics: studying how people work together and how they use information and communication technologies. His most recent research programs include: Investigating how software development can be improved through attending to the social aspects of working together; studying how people adapt to working with large-scale information systems implementations (such as enterprise resource packages); and understanding the changes to organizations (and organizational work) due to the increased distribution of computing.

Paul Gorman, moderator of the panel, is a general internist whose medical informatics research focuses on how clinicians manage information to help patients.

"Despite the fact that these systems are often justified on the grounds that they would help offload work from harried practitioners, we find that they in fact create new additional tasks, force the user to adopt new cognitive strategies, require more knowledge and more communication, at the very times when the practitioners are most in need of true assistance."

Woods and Patterson, 2000